Some Bad News is Good News for Foreign Investors: The Case of Intellectual Property Rights Infringement in China*

[Running Head: Some Bad News is Good News for FDI: IPR Infringement in China]

Executive Summary

Despite China's attractiveness to foreign investors, intellectual property rights (IPR) protection in China has not caught up with the international standards. This research aims to quantify the relationship between IPR violations, government effectiveness, and their impact on foreign direct investment (FDI) inflows in the context of China. Our econometric modeling and estimation based on provincial level data over 2002-2012 show that in an early development stage of law and regulatory enforcement, the bad news of a rising number of IPR dispute cases signals the good news of an improvement in law and regulatory enforcement, which encourages IPR owners to raise legal cases. By contrast, in the later development stage when law and regulatory enforcement has become much more effective, the bad news of a rising number of IPR disputes manifest itself as real bad news. Furthermore, this study confirms that the government effectiveness is one of the key factors promoting FDIs.

Keywords: Foreign Direct Investment, Dual Track System of IPR Enforcement, IPR infringement, Local Protectionism, Government Effectiveness, China

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1. Introduction

China has experienced rapid economic development and growth since the initiation of market reform in 1978 and has emerged as a key player in global trade and financial market. China became the world's largest exporter of goods in 2009 and overtook the US as the world number one trading nation in 2013, with a trade volume over US$4 trillion (WTO, 2014). According to the latest International Monetary Fund (IMF) figures (IMF, 2014), China also surpassed the US as the world's largest economy in 2014 in terms of GDP based on purchasing power parity (PPP). In 2014, China's PPP-adjusted GDP reached US$17.63 trillion or 16.48 % of the world's total, compared with the corresponding US figures of US$17.4 trillion or 16.28 % of the world's total. Such rapid economic development has made China the world's largest recipient of foreign direct investment since 2002. In 2014, China attracted US$ 128 billion of FDI (UNCTAD, 2015). Despite China's increased role in the global economy and attractiveness to foreign investors, it has been widely acknowledge that the level of intellectual property rights (IPR) protection in China has not caught up with the international standards. This disparity between the China's emerged economic power at the global level and its weak enforcement mechanisms for IPR laws at the national level has made IPR protection in China be one of the top concerns in the global business community. According to the latest figures, 72%, 77%, and 87% of the total counterfeiting and infringing goods seized at the US, EU, and Japan customs, respectively, came from China in 2012 (US IPR Seizure Statistics 2012, Commission, 2013; Japan Customs, 2013).

This great concern by the global business community has stimulated an emerging body of literature dealing with the issue of weak IPR protection in China and the implications for multinational enterprises (MNEs) in the disciplines of law (e.g., Kassner, 2012; Chow, 2010; Rezler, 2010; Sepetys and Cox, 2009; Gabriel, 2008) and business management and

economics (e.g., Zimmerman and Chaudhry, 2009; Chapa and LeMaster, 2007; Yu, 2007; Hung, 2003). Surprisingly, however, there has been a lack of formal econometric work in the literature to quantify the relationship between IPR violations, government effectiveness, and their impact on FDI inflows in the context of China-specific institutional environment. In light of the growing significance of China in the global economy, it is of both academic and policy importance to investigate the interactive relationship between IPR infringement incidence and the government effectiveness and further to explore how and to what extent IPR infringement disputes and government effectiveness affect business activities of foreign firms in China.

This research aims to fill this important niche. Drawing on insights from a broad theoretical literature, this paper develops two econometric models. The first one suggests a non-linear relationship between the observed relative level of infringement claim cases and the level of government effectiveness, where the observed count of infringement cases equals the total number of infringement incidences times the probability of filing a claim with the regulatory authorities. The second model suggests that the attractiveness of a host region for multinational enterprises (MNEs) is closely associated with the effectiveness of IPR law and regulatory enforcement and the government effectiveness of the regional authority. MNEs prefer to make their investments in host regions with more transparent and effective institutional framework. A quadratic specification is adopted to test these two models. The dataset for the testing include the number of patent infringement claim cases under administrative investigation in 30 provinces (including 4 provincial-level municipalities) of China during 2002-2012, and the government effectiveness index in 30 Chinese provinces constructed by the World Bank in 2006. The Hausman-Taylor estimator is employed to run the econometric estimations because this estimator allows for the time-invariant regressors (c.f. Government effectiveness) to be correlated with the unobserved individual effects. The

estimation results are in line with our expectation. The first set of results confirms an inverted-U shaped curvilinear effects running from government effectiveness to the relative level of the number of infringement claim cases. The second set of results show that government effectiveness has a direct impact on FDI inflows, indicating that a host region with a better government effectiveness attract more FDI inflows; furthermore, the relative level of the count of infringement claim cases have a positive impact on FDI inflows. The results are robust to a number of popular control variables.

The rest of the paper is organized as follows. Section 2 outlines the institutional foundation of IPR regimes in China. In section 3, based on analytical discussions on IPR protection, government effectiveness and FDI, we develop two models to characterize the relationship between the number of infringement claim cases and index of government effectiveness, and between FDI inflows, the relative level of the number of infringement claim cases and the index of government effectiveness. In Section 4, we define the key variables and suggest the best available estimation method – the Hausman-Taylor estimator. In Section 5, we estimate the models using the Hausman-Taylor estimator and report the empirical results. Finally, Section 6 discusses the theoretical and policy implications of the findings and presents concluding remarks.

2. Intellectual Property Rights (IPR) Protection in China

2.1 China as a key source of counterfeit goods to the world market

The recent surge in exports of counterfeits worldwide and in particular, those from China to other countries, has caused many world leading MNCs to declare intellectual property rights (IPR) infringements to be an urgent global business problem (Economist, 2010). It is virtually

impossible to accurately estimate the value of infringing goods originating from China, but it is evident that infringing production in China has grown alongside the remarkable growth in the Chinese economy and export (Chow, 2010, Zimmerman and Chaudhry, 2009;). In 2012, the US, EU and Japan reported a total of 139,928 seizures of shipments of counterfeit and infringing goods by their customs authorities, which represents more than a five-fold increase from the 24,621 cases in 2003.[1]

China is generally acknowledged as the world's number one source of counterfeit and infringing goods in recent years. For example, the total value of infringing goods seized at the US ports of entry was $ 1.26 billion in 2012. Of this total, more than $ 900 million, or 72% of the total, originated from China (US IPR Seizure Statistics 2012). In the same year, infringing products from China accounted for 77 % and 87 % of the total amount seized by the customs authorities of the European Union and Japan respectively (European Commission, 2013; Japan Customs, 2013).[2]

2.2 A wide gap between formulation of IPR regimes and its enforcement

In recent year, it is observed that IPR laws in China have been increasingly converging with international standards (Kassner, 2012; Sepetys and Cox, 2009; Gabriel, 2008; Yu, 2007). China joined several international organizations and agreements, and promulgated domestic

[1] Authors' calculation, based on U.S. Customs and Border Protection Office of International Trade, 2004, 2013; European Commission, 2013; Japan Customs, 2008, 2013.

[2] Based on the assumption that most of the counterfeit and infringing goods exported from Hong Kong were actually produced in China (Chow, 2010), the total value of seized counterfeit and infringing goods exported from China and Hong Kong to the U.S., EU and Japan totalled $ 1.1 billion, € 862.9 million, and ¥ 18.4 billion in 2012, which accounted for 84 %, 87 % and 94 % of all seizures respectively (Authors' calculation, based on U.S. Customs and Border Protection Office of International Trade, 2013 on slides 10-11; European Commission, 2013: p.7 and p.18; Japan Customs, 2013, IMPORT 9 in p.8).

legislation, including the Trademark Law of the People's Republic of China in 1982 and the Patent Law of the People's Republic of China in 1984. In 2001, China joined the WTO and since then further amended its IPR laws and regulations comply with the WTO agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (Rezler, 2010; Chapa and LeMaster, 2007). In spite of continuous development of China's intellectual property law following the international standards, the enforcement of intellectual property laws in China has not consistently met international expectations (Kassner, 2012; Yu, 2007). A wide gap between the formulation of IPR regimes and its enforcement in China has been observed and widely acknowledged. The persistence of the gap is regarded as being rooted in a combination of (i) regional disparity in economic development (Yu, 2007), and (ii) federalism-Chinese style, which is characterized as decentralized, multi-layer, multi-regional governance structure with relatively much harder budget constraints for lower level local governments, and inter-jurisdictional competition (Weingast, Qian, and Montinola, 1995; Cao, Qian, and Weingast, 1999). Regional disparity in economic development implies diverse interests among provincial and municipal governments with respect to enforcement of IPR laws. For some local governments, intellectual property infringement is in fact beneficial to their local economies because it can create new jobs and tax revenues (at least) in the short term (Chow, 2010; Tao, 2007). With local protectionism under the China-specific decentralized governance structure, some local governments with relative low levels of economic development prioritize the protection of local interest before that of national interest of complying China's IPR regimes with the international standards. Therefore, these local governments are likely reluctant to impose strict enforcement measures against alleged infringement cases (Chow, 2010; Gabriel, 2008; Tao, 2007; Cox and Sepetys, 2005; Wang, 2004).

3. Theoretical Background and Model Development

3.1 Influence of government effectiveness on patent infringement claims in China

Following the logic of gradualist reform, China has adopted a dual track system of IPR enforcement (Kassner, 2012; Cox and Sepetys, 2005; Wang, 2004). The first track is the judicial enforcement process, which involves filing a complaint to a judicial civil court. The second track is the administrative enforcement process, which is regarded as one of the distinctive features of China's IPR protection regime. On the administrative track, the administrative agencies investigate infringement cases and penalize the guilty party. Due to the legacies of the China's centrally planned economy system, the administrative proceedings have been played the arguably most important role in IPR enforcement (Kassner, 2012). Therefore, the number of administrative infringement claim cases under investigation in a province can be regarded as an informative indicator of the extent to which the province commits to combat IPR infringements. Table 1 reports the spatial distribution of patent infringement claimed through the administrative track by three provincial groups for 2002-2012. From 2002 to 2012, the number of patent disputes handled by local IP administrative authorities totalled 14,451 cases. In terms of geographical distribution, more than 70% of patent infringement was claimed in the coastal region in 2002. While the coastal region retained its dominant position in infringement claims, its share in the national total decreased by 21.64 percentage points from 72.34% in 2002 to 50.70% in 2011. The central region took 18.72 percentage points of the share from the coastal region. The west basically kept the same growth pace with that of the national total, swinging between 11.15% and 17.89%. The coefficient of variations (CV) across the three regions shows a decline trend and decreased by about 50% from 2002 to 2012, implying a tendency of reduced disparity.

Insert Table 1 about here

In modeling the influence of government effectiveness on IPR enforcement, the most relevant and available data in China is the number of patent infringement cases claimed, *claim count*. It can be decomposed into

$$Claims\ Count\ =\ Total\ Infringement\ Count\ (TIC)\ \times\ \Pr\ of\ Claim \tag{1}$$

This decomposition captures two distinct aspects of patent infringement cases. *TIC* can be considered as the "supply side" of the infringement claims as it defines the maximum possible number of infringement claims. The level of the supply side activity would be affected by the usual business environments such as the market size, the expected benefits of those business activities which are based on patent piracy, and the potential punishment if being caught by government's enforcement agencies. It would be natural to expect *TIC* to be negatively correlated with the law and regulatory enforcement as tighter enforcement will increase the probability of being caught, getting unfavorable ruling, and paying damage compensation. In other words,

$$TIC = \delta_1 LE + w_1 \mathbf{Z_1} + \varepsilon\,, \tag{2}$$ [3]

with $\delta_1 < 0$. In Eq. (2), *LE* means the effectiveness of law and regulatory enforcement and $\mathbf{Z_1}$ denotes the vector of other factors that affect the level of piracy activities.

Please note that not all patent infringement cases are brought to the attention of regulatory bodies. Some cases are simply not caught on radar of patent holders. Even if patent holders know the existence of solid infringement cases, however, they may not want to

[3] This model can be interpreted as a first order approximation of a more general model, $TIC = f(LE, \mathbf{Z_1})$.

bring such cases to the government or the court because the costs of legal actions may exceed the expected benefits. Generally speaking, under a weaker enforcement system, a case is less likely to be accepted and then ruled favorably to the patent holders. This will lead to a lower probability of filing claims. In recognizing this, we posit that the "demand side" of piracy claims is positively correlated with the law and regulatory enforcement and thus,

$$\Pr \ of\, Claim = \delta_2 LE + w_2 \mathbf{Z_2} + \varepsilon, \tag{3}$$

where $\mathbf{Z_2}$ denotes the vector of other variables affecting the probability of filing claim, and we expect $\delta_2 > 0$.

Given that *Claims Count* is the product of *TIC* and probability of claims and the two multiplying factors have opposite correlation signs with respect to *LE*, we do not know which effect would dominate a priori. Therefore, we allow for non-linearity in our operational model for econometric estimation as follows:

$$Claim\ Count = \alpha_1 LE + \alpha_2 LE^2 + \alpha_3 \mathbf{Z} + \varepsilon, \tag{4}$$

in which **Z** incorporate control variables of both Eqs. (2) and (3).

3.2 Influence of government effectiveness on activities of foreign funded enterprises in China

Since the seminal work of La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997, 1998), a growing body of research in political economy and finance has suggested legal origin, whether a country follows common laws or civic laws, has persistent impacts on various dimensions of legal institutions, which in turn leads to systematic difference in economic performance. La Porta et al. (1997, 1998) argues that common law countries tend to have better investor protection, measured by quality of legal rules and law enforcement than civil law countries, and thus are more likely to house broader equity and debt markets. Djankov et

al. (2007) shows that a country with better creditor protection is more likely to have developed private credit market. Djankov et al. (2008) demonstrate that stronger debt enforcement is positively correlated with GDP per capita and debt market development. These studies find evidence that effective legal rules and law enforcement are conducive to protection of outside investors' rights, which in turn promotes external financing.

In the international business literature, recent empirical evidence has shown that effective institutional environment in a host country is an important determinant of foreign direct investment inflows (Globerman and Shapiro, 2003; Seyoum, 2009; Mengistua and Adhikary, 2011; Hsu and Tiao, 2015). Using international data on FDI inflows and outflows, Globerman and Shapiro (2002) find that good governance affects the security of property rights, transparency of government and legal processes and thus attract more FDI inflows. Also, using a probit model with data on outward FDI from the United States, Globerman and Shapiro (2003) argue that good institutions in host countries establish a conducive climate to the multinational companies from the USA. By examining the effects of the World Bank's notion of good governance on FDI inflows in 15 Asian countries, Mengistua and Adhikary (2011) find that political stability and absence of violence, government effectiveness, rule of law, and control of corruption are the key determinants of FDI inflows. These findings highlight the importance of improving domestic governance environment for attracting FDI inflows, which is also confirmed by Seyoum (2009), finding that strong formal institutions in host countries attract more FDI flows. Hsu and Tiao (2015) investigate the relationship between patent rights protection and inward FDI in eleven Asian countries and their empirical results indicate that the strengthening of patent rights protection has a positive impact on inward FDI in Asian countries.

In line with the above discussion, we specify the following model to quantify the impact of IPR protection level and government effectiveness measurement on the business activities of foreign funded enterprises in China.

$$FFE\ Activity = \beta_1 Claim\ Count + \beta_2 LE + \beta_3 \mathbf{Z} + \varepsilon \quad (5)$$

where *FFE Activity* is the level of foreign funded enterprises' business activities and **Z** is the vector of control variables as we defined before. One may argue that a larger number of claims may signal weak IRP protection, which in turn deters foreign firm's activities. If it is true, we would expect $\beta_1 < 0$. However, our discussion in this and previous subsections has implied that the effect of claim counts on FFE activities may differ owing to the regional heterogeneity in IPR protection. For example, in a more developed region with stronger IPR protection, it is plausible that the demand for (or probability of filing) claims is already high. In such a regulatory environment, an increase in claim counts can be interpreted as an increase in IPR infringement, thus representing a negative signal to potential foreign entrepreneurs. By contrast, in a less developed region with a weak IPR protection regime, the total infringement incidents might be already very high. An increase in claim counts here can indicate that the existing IPR entrepreneurs are keener to raise claims upon infringement. This signals that they believe the enforcement of law and regulations in the region is more trustworthy than before, and thus representing good news for potential foreign investors in the region. To test this idea, we adopt the following specification:

$$FFE\ Activity = \beta_1 Claim\ Count + \beta_2 (Claim\ Count) * (Coast) + \beta_3\ LE + \beta_4 \mathbf{Z} + \varepsilon \quad (5')$$

where *Coast* represents a dummy variable which takes the value of 1 for the observations from the coastal region and zero otherwise.[4] In general, the coastal (non-coastal) areas have

[4] The coastal regions include Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan.

better (worse) enforcement of law and regulations.[5] Thus, we expect $\beta_1 > 0$ and $\beta_2 < 0$. With regard to *LE*, in line with the standard argument in the literature as reviewed above, we expect that the more effective legal system and government is associated with more active foreign investment, and thus, the coefficient on the *LE* is expected to be positive.

4. Data, Variables, and Estimation Methods

4.1 Dependent Variables

The dependent variable for Eq. (4) is the relative level of patent infringement cases claimed in region *i* and year *t* ($Claim_{it}$), which is measured as the ratio of patent infringement cases claimed in region *i* and year *t* to the national total number of patent infringement cases claimed in year *t*, and is presented in percentage. To measure business activity of MNEs in China which is the dependent variable in Eq. (5), we use the logarithm of the number of foreign funded enterprises in region *i* and year *t* ($\ln FFE_{number,it}$). Data used in our estimations is a panel of 30 provinces and municipalities over the period 2002-2012. Among all 31 provinces and municipalities in China, Tibet is excluded mainly because of data unavailability. The number of patent infringement cases claimed at the provincial level is obtained from *Patent Statistical Yearbook* published by the State Intellectual Property Office of China (SIPO, www.gov.cn). The data source for foreign funded enterprises in China is obtained from *China Statistical Yearbook* (various years) published by the State Bureau of Statistics in China.

5. We use coastal vs. non-coastal classification to sort the regions according to the maturity of law and regulatory enforcement. In unreported robustness tests, we have also performed regressions similar to (5') using different dummy variables such as high vs. low government effectiveness, etc. Our qualitative results are robust to these alternative specifications.

4.2 Independent Variables

The variable representing the effectiveness of law and regulatory enforcement (*LE*) in Eq (4) is the government effectiveness index in the region *i* and year *t* ($Effect_{it}$), which is measured as the average of city-level government effectiveness index across cities in province *i* and year *t* (*t* = 2006). The information on local government effectiveness in China is obtained from World Bank (2006). It was based on a large survey of 120 cities and 12,400 firms conducted in 2006 and has been the most comprehensive survey on government effectiveness in China so far. Since the unit of analysis we adopt in this study is province, we aggregate and organize the survey data into 30 provinces (Table 2). Following the specification of Eq. (4), we take both $Effect_{it}$ and its square to capture the possible non-linear effect of the effectiveness of law and regulatory enforcement (LE^2) on relative level of patent infringement claims.

Insert Table 2 about here

4.3 Control Variables

Although we suggest the importance of the law and regulatory enforcement in determining the level of patent infringement and business activities of MNEs, a number of other factors have been identified in the literature as important determinants of piracy activity levels and FDI. To take into account the effects of those factors, we incorporate a comprehensive set of control variables in our empirical estimations (**Z** in Eqs. (4) - (5')). First, we employ the measures and proxies involving regional market size, regional output of knowledge

production, and regional openness level. In addition, we also include yearly and regional fixed effects to address unobserved time and regional specific characteristics.

Regional market size is measured by the logarithm of gross regional product in the region *i* and year *t* and denoted as $\ln GRP_{it}$. Regional output of knowledge production is defined as the relative level of patent applications in the region *i* and year *t* ($Patent_{it}$), which is measured as the ratio of patent application number in the region *i* and year *t* to the national total number of patent applications in year *t*, and is presented in percentage. The degree of openness ($Open_{it}$) is proxied by the ratio of the total amount of trade (the sum of total export and import value by place of destination or origin) in region *i* and year *t* to the gross regional product in region *i* and year *t* and is presented in percentage. Data sources for constructing all above control variables are *China Statistical Year Book* (various years).

Table 3 presents the summary statistics and the correlation matrix of the variables employed in our empirical regressions.

Insert Table 3 about here

4.4 Econometric Model and Estimation Methods

To test the existence of the non-linear relationship between the relative level of patent infringement claims and government effectiveness with the above-discussed robustness control, we reformulate eq. (4) as follows:

$$Claim_{it} = \beta_0 + \beta_1 Effect_{i,2006} + \beta_2 Effect^2_{i,2006} + \beta_3 \ln GRP_{it} + \beta_4 Patent_{it} + \beta_5 Open_{it} + u_i + \nu_t + \varepsilon_{it} \quad (6)$$

where u_i and ν_t capture region- and year-specific effects, respectively, and ε_{it} is an error term.

We also reformulate eq (5) and (5') to test relationship between MNEs' business activities, relative level of patent infringement claims and government effectiveness with the same set of robustness control:

$$FFE_{number,it} = \beta_0 + \beta_1 Claim_{it} + \beta_2 Effect_{i,2006} + \beta_3 \ln GRP_{it} + \beta_4 Patent_{it} + \beta_5 Open_{it} + u_i + \nu_t + \varepsilon_{it} \quad (7)$$

$$FFE_{number,it} = \beta_0 + \beta_1 Claim_{it} + \beta_2 Claim_{it} * Coast + \beta_3 Effect_{i,2006} + \beta_4 \ln GRP_{it} + \beta_5 Patent_{it} + \beta_6 Open_{it} + u_i + \nu_t + \varepsilon_{it} \quad (7')$$

Panel data method is used to control unobserved individual effects in the data. To choose fixed or random effects, the Hausman test is conducted and it reveals that the unobserved individual effects are correlated with the regressors. Therefore, the fixed effects estimator is the preferred model. However, one of the main disadvantages of the fixed effects estimator is that it wipes out the effects of time-invariant regrossors (e.g., $Effect_{i,2006}$). Using Monte Carlo experiments, Baltagi, Bresson, and Pirotte (2003) shows that the random effects model leads to misleading inference if some regressors are correlated with the individual effects. We use the Hausman-Taylor model (1981) to address this issue. By using the individual means of exogenous regressors as instruments for the time invariant regressors, the Hausman and Taylor (1981) estimator recaptures the estimates of time-invariant regressors under a model where some of the regressors are correlated with the individual effects. In our empirical exercises, however, we report both random effect and Hausman-Taylor estimations for Eq. (6) and both fixed effect and Hausman-Taylor estimations for Eqs. (7) and (7') to show the advantage of Hausman-Taylor methods and also the robustness of our key results with respect to estimator choice.

5. Empirical Results

5.1 Impact of government effectiveness on patent infringement claims in China

Eq. (6) is estimated by the random effects and Hausman-Taylor estimators, respectively. The estimation results are presented in Table 4. Let us first look at the results of columns 1 and 3, which focus on the linear effect of $Effect_{i,2006}$ only. The coefficient estimations of $Effect_{i,2006}$produced by random effects and Hausman-Taylor estimators are statistically insignificant and this suggests that the non-linear effects of government effectiveness on claim counts may have cancelled out in the linear setting. Columns 2 and 4 investigate the non-linear effect hypothesis using random-effect and Hausman-Talyor methods. The results support an inverted U-shaped relationship between government effectiveness and the relative level of infringement claims. For instance, the coefficients of $Effect_{i,2006}$($\hat{\beta}_1 =$ 0.387) and $Effect^2_{i,2006}$($\hat{\beta}_2 = -0.003$) support an inverted U-shaped relationship between law enforcement effectiveness and the relative level of infringement claims. This result suggests that in the early development stage of law and regulatory enforcement, the marginal effect of tighter enforcement on the probability of encouraging patent owners to raise cases (Pr $of\ Claim$ in Eq. (1)) is greater than that on reducing the violations of patent rights (*TIC* in Eq. (1)), as a result, tighter enforcement is associated with a higher level of infringement claims. It is in this sense we say that such bad news as a higher level of infringement claims is good news for foreign investors because it signals an improvement in law and regulatory enforcement in the region. By contrast, in the latter development stage when the effectiveness of law and regulatory enforcement has reached a high level, the marginal effect of tighter enforcement on reducing *TIC* is greater than that on Pr $of\ Claim$ and thus tighter enforcement will lead to reduced number of violation cases.

With regard to control variables, their coefficients all are positive and statistically significant in Eq. (6). This implies that a region with a larger regional market size ($\ln GRP_{it}$), a greater regional output of knowledge production ($Patent_{it}$), and a greater degree of openness ($Open_{it}$) is likely to experience a relatively higher level of infringement claim cases.

Insert Table 4 about here

5.2 Impact of government effectiveness on activities of foreign funded enterprises in China

Eqs. (7) and (7') are estimated by fixed effects and Hausman-Taylor estimators. The estimation results are presented in Table 5. Models 1-3 in Table 5 test the impacts of claim cases ($Claim_{it}$) and government effectiveness ($Effect_{i,2006}$) separately. Model 1 examines the role of the claim variable without the coastal region dummy and using the fixed effect approach. Not surprisingly, the coefficient on claims count is statistically insignificant. As hinted in section 3.2, it is possible that the signs of the coefficient on claim cases are different across regional zones with different effective level of law and regulatory enforcement. In the presence of such disparity, the average effect could become insignificantly. Model 2 addresses this concern with the help of the coastal area dummy. In Model 2, the coefficient of $Claim_{it}$ variable is significantly positive and the coefficient of $Claim_{it} \times Coast$ is negative (with a *p* value = 0.105). Consistent with our expectation in Section 3.2, these results indicate that a higher level of claims count number in the coastal provinces is associated with a lower

level of FDI activities and the opposite relationship holds in the inland regions. This contrast suggests that an increase in claim counts in different types of regions sends different signals to potential foreign investors. In inland provinces where the base-number of total infringement case has been already relatively high, more claim-counts would mean a higher probability of filing claims, which reflects the incumbents' confidence that the law and regulatory enforcement in the region is improving. This is good news to foreign investors. On the contrary, the coastal regions have a relatively much more effective enforcement system, which would lead to a higher probability of filing claims. Thus, an increase in claim counts in coastal regions can be a result of increasing infringement activities and this comes as bad news. In Model 3, the positive and statistically significant coefficient of $Effect_{i,2006}$ indicates that the number of foreign funded firms is positively related to the level of regional government effectiveness, consistent with the literature.

Models 4 and 5 assess the effect of both $Claim_{it}$ and $Effect_{i,2006}$ jointly. Consistent with the results from Model 1, the coefficient of $Claim_{it}$ is insignificant when regional disparity (coastal vs inland regions) is not accounted for. The coefficient of $Effect_{i,2006}$ in Model 4 is significantly positive but the magnitude of the marginal effect is weaker than that of Model 3 (0.005 vs. 0.021). Nevertheless, when we take into account regional disparity in the effects of $Claim_{it}$ by including an interaction term ($Claim_{it} \times Coast$), the coefficients of both $Claim_{it}$ ($\beta = 0.020$) and $Claim_{it} \times Coast$ ($\beta =$ -0.024) become statistically significant even if the quality of government effectiveness and other influential factors are controlled for. Again, these results support our expectation in Section 3.2. The coefficients of $Effect_{i,2006}$ in Models3-5 are consistently positive and statistically significant as conventionally expected.

Turning to control variables, their coefficients are positive and statistically significant across all models in Table 5, except the coefficient of $Patent_{it}$ which is statistically insignificant in all 5 models.

Insert Table 5 about here

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6. Discussions and Conclusions

Despite an emerging body of literature on the issue of weak and uneven IPR protection in China, there has been a lack of econometric research to quantitatively assess the relationship between IPR violations and government effectiveness and further their impact on FDI inflows in the context of China. This study has addressed this challenge and thus filling an important niche in the literature.

This study takes into consideration infringement disputes, government effectiveness and inward FDI in the context of China's institutional environment and develops two models. The first model addresses the non-linear relationship between the relative level of infringement claim cases and the effectiveness level of law and regulatory enforcement across provinces in China. The second model characterises the important role played by government effectiveness and law enforcement in attracting foreign investors. The empirical estimation of the second model also reveals that regional disparity in the effectiveness of law and regulatory enforcement lead to different signalling effect of IPR infringement claim cases to foreign investors.

Because one of the key independent variables, government effectiveness ($Effect_{i,2006}$) is time-invariant and some of the independent variables are correlated with the

individual effects, we employ the Hausman-Taylor method to estimate our panel-data models and to detect the non-linear relationship between the relative level of infringement claim cases and the effectiveness level of law and regulatory enforcement across provinces in China. Using the number of patent infringement claim cases under administrative investigation in 30 provinces of China during 2002-2012 and the government effectiveness index in 30 Chinese provinces constructed by the World Bank in 2006, the estimation results support the specifications of our two models and are consistent with our analytical expectation. The results show that the relationship between government effectiveness and the relative level of infringement claim cases is non-linear and exhibits an inverted-U shaped effects. This result suggests that in an early development stage of law and regulatory enforcement, the bad news of a rising number of IPR dispute cases signals the good news of an obvious improvement in the effectiveness of law and regulatory enforcement which encourages patent owners to raise legal cases. By contrast, in the later development stage when law and regulatory enforcement has become relatively much more effective, the bad news of a rising number of IPR dispute cases does manifest itself as real bad news. In addition, this study confirms that the government effectiveness is one of the key factors promoting FDI activities.

Our finding offers an interesting policy implication. Suppose that policy makers in developing country/region consider implementing more stringent IPR enforcement to attract more foreign investment. It is highly likely that such an implementation will lead to an initial increase in IPR claims counts, which may become news headlines. Our findings suggest that the policy makers should not worry about such media attention and continue to focus on improving the effectiveness of law and regulatory enforcement, because intelligent investors will read such headlines as good news and become more willing to invest in the country/region.

In addition to the revealing of the above insight, this study also contributes to the international business literature by quantitatively modelling the effects of government effectiveness on the IPR infringement claim numbers and FDI inflows. Our modelling framework and the associated empirical testing methods are clearly applicable to similar data from other countries. Future research in this direction would be able to check the extent to which the findings of this research can be generalized.

Two limitations of this study are worth mentioning. First, the government effectiveness index (World Bank, 2006) this study has adopted is only available for one year. Although this index is the most comprehensive and reliable so far and the issue of time-invariance variable in regression model can be addressed by Hausman-Taylor estimator, it might not be able to capture the effect of government effectiveness over time. Future research could examine this issue when updated government effectiveness index becomes available across provinces and also over time. Second, the number of infringement claim cases this study has used is based on patent infringement only and do not cover other sources of infringement such as counterfeiting goods, trademark, copyrights etc. Future research should work with various sources of infringement.

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Table 1. Patent infringement cases claimed and closed in China

Panel A. Regional distribution of patent infringement cases claimed									
Year	Coast		Central		West		China		Coefficient of variation among coast, central and west regions
	Cases	(%)	Cases	(%)	Cases	(%)	Cases	(%)	
2002	1,012	(72.34)	231	(16.51)	156	(11.15)	1,399	(100)	1.02
2003	926	(63.95)	303	(20.93)	219	(15.12)	1,448	(100)	0.80
2004	919	(64.99)	315	(22.28)	180	(12.73)	1,414	(100)	0.83
2005	870	(63.97)	313	(23.01)	177	(13.01)	1,360	(100)	0.81
2006	780	(63.57)	265	(21.60)	182	(14.83)	1,227	(100)	0.79
2007	635	(64.40)	199	(20.18)	152	(15.42)	986	(100)	0.81
2008	686	(62.82)	279	(25.55)	127	(11.63)	1,092	(100)	0.79
2009	573	(61.15)	211	(22.52)	153	(16.33)	937	(100)	0.73
2010	547	(50.79)	359	(33.33)	171	(15.88)	1,077	(100)	0.52
2011	652	(50.70)	453	(35.23)	181	(14.07)	1,286	(100)	0.55
2012	1,313	(59.01)	514	(23.10)	398	(17.89)	2,225	(100)	0.67

Note: Coast Region includes Guangdong, Jiangsu, Shandong, Shanghai, Fujian, Zhejiang, Liaoning, Beijing, Tianjin, Hebei, Hainan; Central Region includes Guangxi, Hubei, Hunan, Jiangxi, Henan, Anhui, Heilongjiang, Jilin, Shanxi, Inner Mongolia; West Region includes Chongqing, Sichuan, Shaanxi, Yunnan, Gansu, Guizhou, Qinghai, Xinjiang, Ningxia, Tibet.

Source: Calculated by authors based on *Patent Statistical Yearbook*, 2002-2013.

Table 2. Cities surveyed and average of government effectiveness index at provincial level

Province/ municipality	City	Average of government effectiveness index at provincial level
Beijing (1)	Beijing	52.00
Tianjin (2)	Tianjin	60.50
Hebei (8)	Baoding, Cangzhou, Handan, Langfang, Qinhuangdao, Shijiazhuang, Tangshan, Zhangjikou	59.25
Shanxi (3)	Datong, Taiyuan, Yunchang	98.50
Inner Mongolia (2)	Baotou, Huhehaote	87.50
Liaoning (6)	Anshan, Benxi, Dalian, Fushun, Jinzhou, Shenyang	75.58
Jilin (2)	Changchun, Jilin	94.00
Heilongjiang (3)	Daqing, Haerbing, Qiqihaer	100.67
Shanghai (1)	Shanghai	51.50
Jiangsu (9)	Changzhou, Lianyungang, Nanjing, Nantong, Suzhou, Wuxi, Xuzhou, Yancheng, Yangzhou	47.50
Zhejiang (8)	Hangzhou, Huzhou, Jiaxing, Jinhua, Ningbo, Shaoxing, Taizhou, , Wenzhou	31.19
Anhui (4)	Anqing, Chuzhou, Hefei, Wuhu	63.00
Fujian (5)	Fuzhou, Quanzhou, Sanming, Xiamen, Zhangzhou	39.10
Jiangxi (5)	Ganzhou, Jiujiang, Nanchang, Shangrao, Yichun	56.40
Shandong (9)	Jinan, Jining, Linyi, Qingdao, Taian, Weifang, Weihai, Yantai, Zibo	20.94
Henan (7)	Luoyang, Nanyang, Shangqiu, Xinxiang, Xuchang, Zhengzhou, Zhoukou	62.36
Hubei (7)	Huanggang, Jingmen, Jingzhou, Wuhan, Xiangfan, Xiaogan, Yichang	77.36
Hunan (6)	Changde, Changsha, Chenzhou, Hengyang, Yueyang, Zhuzhou	100.00
Guangdong (9)	Dongguan, Foshan, Guangzhou, Huizhou, Jiangmen, Maoming, Shantou, Shenzhen, Zhuhai	21.17
Guangxi (3)	Guilin, Liuzhou, Nanning	85.83
Hainan (1)	Haikou	86.50
Chongqing (1)	Chongqing	57.00
Sichuan (5)	Chengdu, Deyang, Leshan, Mianyang, Yibin	65.00
Guizhou (2)	Guiyang, Zunyi	97.50
Yunnan (3)	Kunming, Qujing, Yuxi	76.17
Shaanxi (3)	Baoji, Xian, Xianyang	61.67
Gansu (2)	Lanzhou, Tianshui	101.00
Qinghai (1)	Xining	102.00
Ningxia (2)	Wuzhong, Yinchuan	64.75
Xinjiang (1)	Wulumuqi	77.00

Source. Calculated by authors based on World Bank (2006); A smaller index value indicates higher level of government effectiveness.

Table 3. Descriptive statistics and correlation matrix[a,b]

	Mean	*S.D.*	*Min.*	*Max.*	(1)	(2)	(4)	(5)	(6)
(1) $Claim_{it}$	3.331	4.763	0	29.664	1.000				
(2) $Effect_{it}$	69.098	23.245	20.944	102	-0.610	1.000			
(3) $\ln GRP_{it}$	8.785	1.016	5.797	10.952	0.515	-0.533	1.000		
(4) $\ln Patent_{it}$	3.333	4.541	0.045	25.067	0.718	-0.669	0.582	1.000	
(5) $Open_{it}$	34.312	42.913	3.572	174.968	0.412	-0.569	0.353	0.677	1.000

[a] N = 330.
[b] All correlation coefficients are significant at $p < 0.001$.

Table 4. Estimation results: Effects of Governance effectiveness on infringement claims

	Random effects	Random effects	Hausman-Taylor	Hausman-Taylor
Independent Variables				
$Effect_{i,2006}$	0.037 [0.028]	0.448*** [0.103]	-0.004 [0.039]	0.387*** [0.163]
$Effect^{2}_{i,2006}$		-0.003*** [0.001]		-0.003*** [0.001]
Control Variables				
$\ln GRP_{it}$	1.580** [0.680]	1.244** [0.602]	3.284*** [1.170]	2.265** [1.126]
$Patent_{it}$	0.204*** [0.069]	0.177*** [0.068]	0.155** [0.070]	0.146** [0.070]
$Open_{it}$	0.024** [0.010]	0.018** [0.009]	0.030*** [0.011]	0.026*** [0.010]
Constant	-8.053 [6.605]	7.264 [6.770]	-24.413** [11.192]	-5.647 [11.950]
Wald Chi^2	62.38***	95.48***	50.49***	65.06***
R^2	0.485	0.635		

† N = 330.
†† Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
††† Numbers in [ ] are standardized errors.

Table 5. Estimation results: Effects of government effectiveness on FDI

	Model 1 (Fixed effects)	Model 2 (Fixed effects)	Model 3 (Hausman-Taylor)	Model 4 (Hausman-Taylor)	Model 5 (Hausman-Taylor)
Independent Variables					
$Claim_{it}$	0.004 [0.007]	0.020* [0.012]		0.004 [0.007]	0.020* [0.012]
$Claim_{it} \times Coast$		-0.024# [0.015]			-0.024* [0.014]
$Effect_{i,2006}$			0.021*** [0.005]	0.005*** [0.007]	0.023*** [0.005]
Control Variables					
$\ln GRP_{it}$	0.477*** [0.031]	0.470*** [0.032]	0.485*** [0.032]	0.484*** [0.032]	0.478*** [0.032]
$Patent_{it}$	-0.008 [0.008]	-0.007 [0.008]	-0.005 [0.008]	-0.006 [0.008]	-0.004 [0.008]
$Open_{it}$	0.009*** [0.001]	0.010*** [0.001]	0.010*** [0.001]	0.010*** [0.001]	0.010*** [0.001]
Constant	3.886*** [0.275]	3.933* [0.276]	5.333*** [0.477]	5.315*** [0.479]	5.429*** [0.487]
F-statistics/Wald Chi^2	97.93***	91.62***	1365.85***	1362.39***	1317.371***
R^2	0.836	0.823			

† N = 330.
†† Significance levels: # = 0.105, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
††† Numbers in [ ] are standardized errors.